**CHAPTER 2: LITERATURE SURVEY**

Medication adherence with smart phones: Mobile apps for medication adherence are regarded as the novel innovative and non-invasive approach to evaluating and improving no adherence rates in patients (Gauthier and Cardot, 2012). Using smartphone apps for medication adherence is fast gaining prominence and the number of medication adherence apps available in the market has significantly increased over the last few years (Dayer et al., 2013). These can potentially consolidate all the medication-specific information creating a repository for patients; are constantly accessible and provide a systematic and efficient process to coach the patients about their disease condition and care. Dayer et al., (2013) also emphasise that they are available for little or no cost, and while the smartphone medication adherence–oriented app can benefit anyone taking prescription medications these are particularly beneficial for patients with complex medication regimens.

Currently across the dominant smartphone platforms there is an upsurge of apps aimed at supporting patients for organizing and adhering to their medications. As outlined features of the apps that are presently available in the market include reminders for taking and refilling medicines, calendar-based alarm reminders with specific dosages and facilities for data logging that can be accessed by both patients and healthcare providers. Integration of medication lists with pharmacy contact information and prescription drug discount cards are all immediately accessible by way of these apps. Additionally these also include medication information likes dosages, side effects, toxicities, etc.

The potential benefits of the medication adherence app are many, and efforts are currently under way to advance their usage by integrating smartphones with health-monitoring devices that transmit the output data directly to patients or physicians. It is noteworthy however that their efficacy in terms of improving the effectiveness and decreasing the costs of traditional medication adherence has not been empirically tested to a large degree.

Currently available medication adherence apps

A variety of medication adherence apps are currently available on multiple smart phone operating systems. The prominent features that most of these apps offer are listed.

Features Description Online data entry App has companion website(s) that allow data and medication regimen entry from a computer Complex medication instructions App has the capability to schedule medication instructions including dose administrations that occur non-daily, monthly, every X days; or medications with stop dates

Cloud data storage App has the capability to back up and retrieve a medication regimen from a cloud storage system Database of medications A medication database is available that allows the user to enter, search, and select medications using features such as auto population

Sync/export/print data App has the capability to transmit, print, or export medication regimens and/or medication-taking behaviours for use by the patient or health care providers

Tracks missed and taken doses App has the capability to remind patients to take their medication and to record taken and missed doses that could potentially be used to calculate adherence rates

Provider data input capable App allows providers to input and maintain the patient’s medication regimen and “push” the regimen to the patient’s device

Multiple platform app App is available on more than one platform Free-only apps App is completely free (i.e., no fees for pro upgrades or charges to unlock additional features)

Generates reminders with no connectivity

App has the capability to generate medication reminders without the use of cellular (3G/4G/LTE) or wireless (Wi-Fi) connectivity

Statement of HIPAA\* compliance App has a statement from their manufacturer claiming HIPAA compliance Multiple profile capable App has the capability to generate medication reminders for multiple individuals on different medications (i.e., enabled family use)

Multilingual App is available in English plus any other language

Adherence management: role of pharmacists

Pharmacists play an essential role as the medication expert and are well-positioned to

Improve medication use in patients through individualized recommendations. Being trained in the pharmacology and pharmacokinetics of medication, pharmacists can proficiently guide patients and are capable of managing patients’ medication therapy of chronic health conditions by virtue of their advanced clinical training in the preparation and suitable use of medications.

While designing and rolling out pharmacy focused programs that are personalised toward patients’ requirements can provide significant professional, economic, and therapeutic rewards, implementation of these by pharmacies may seem daunting. However, (KonyWhitepaper) outlines that with the advancement of technologies and the advent of mobile applications whether a pharmacy is small and independent, or has an expansive national network, a positive return on investment in a relatively short period of time can be realised by venturing into the medication adherence regime. The immediate benefits include:

• Patients when given regular reminders and refill notifications are less likely to neglect filling a prescription; this helps the pharmacy providing the alerts in retaining patients and getting reimbursements

• Patients who when engage with their pharmacists regularly are more likely to have additional prescriptions filled from the same place and they may engage in doing additional shopping at the store too.

• Regular interactions between pharmacists and patients with a chronic disease are more likely to develop a sense of patient responsibility, encouraging patients to visit the pharmacy more often.

Thus with the use of technology like smart phone apps independent, community-based pharmacies or retail pharmacies with established networks can reap significant benefits by engaging with their patients in their self-care and encourage greater patient loyalty.

Pharmacy driven apps

Detonator et al., (2015) define a pharmacist-driven app as ‘the mobile technology set up by the pharmacist to ensure accuracy of patient information, to facilitate sharing of patient centred health information and to allow open communication directly with the pharmacist.’ While prior studies like Dyer et al., (2013) and Bailey et al., (2014) have evaluated medication adherence apps for their features, usefulness and ability to support medication self-management. Detonator et al., (2015) emphasises that it is particularly important to understand patients’ perception of these medication adherence mobile apps in terms of their benefits, barriers and desired features. Based on their empirical analysis, Detonator et al., (2015) suggest that patient’s perceptions about the benefits of a pharmacy driven apps can be categorised into four main factors - accessibility, privacy, pros of appearance and beneficiaries.

Accessibility includes patients being able to communicate directly with their pharmacists by way of email or messaging features. Patients prefer the apps being set up for them by pharmacists and do not feel the apps are invasive of their privacy. The study also shows that while patients find the portability of health information beneficial they are willing to be educated and counselled by way of videos on medication administration. They perceive the benefits of pharmacy driven apps in terms of refilling of medications, reminder alarms, recording dosages and the ability to views statistics that tracks their adherence. In terms of the appearance, patients like photographs of the medications, a systematic outline of medications and statistics or graphs displaying their adherence. Moreover, the patient’s perception is that an integrated account that can be used by their family member or caregiver is another beneficial aspect that the apps can offer.

Along with outlining patients’ perception about the benefits of pharmacists driven apps, Detonator et al., (2015) also detail patient’s concerns and the potential barriers in using pharmacist-driven mobile apps. While complexity of use of the apps is the most prominent of the patients concern, they are also anxious about the appearance, background, font size and colour of the apps. The app being hard to download, being bothered by advertisements and rearrangement of app features upon updates are also perceived by patients as barriers to using the apps. Additional usage concerns involved patients needing to manually upload their medications into the app; the displayed pictures of the medications may not match with their actual medicines. Another barrier is cost, as patients are inclined to download only free apps or apps with minimal cost and are not keen to pay a recurrent fee. Privacy and security in terms of their mobile phone being stolen and their prescription information being accessed by others was another barrier. Similarly reliability in terms of connectivity or cellular coverage; breakage or malfunction of the app; phone battery being drained due to app usage are other barriers.

Finally motivation is also perceived as a barrier by patients as they feel that the use of the apps may be time-consuming, there is a fear of technology usage, and some patients may have an attitudinal barrier and not want help with managing medications.